ASME Codes and Standards for the Hydrogen Infrastructure

2004 China-U.S. Standards and Conformity Assessment Workshop

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Summary

- Approach to Hydrogen Infrastructure Standardization
- Background on ASME and C&S
- International standards
- Existing Codes and Standards applicable to H_2
- New Standards Actions
- Invitation to participate

Approach to Standardization

- Traditional approach

  Writing prescriptive standards after technology is established and after commercialization has begun

- Approach for the hydrogen economy

  Writing standards with more performance based requirements during the technology development and before commercialization has begun

Approach to Standardization

Being driven by the US Department of Energy

- Research
  - Hydrogen production
  - Fuel Cell Development
  - Hydrogen storage
  - Materials
- Technology Validation
- Education
- Safety
- Codes and Standards Development

Approach to Standardization - Infrastructure

70 MPa (10,000 psi) GH_2
Vehicle Fuel Tank

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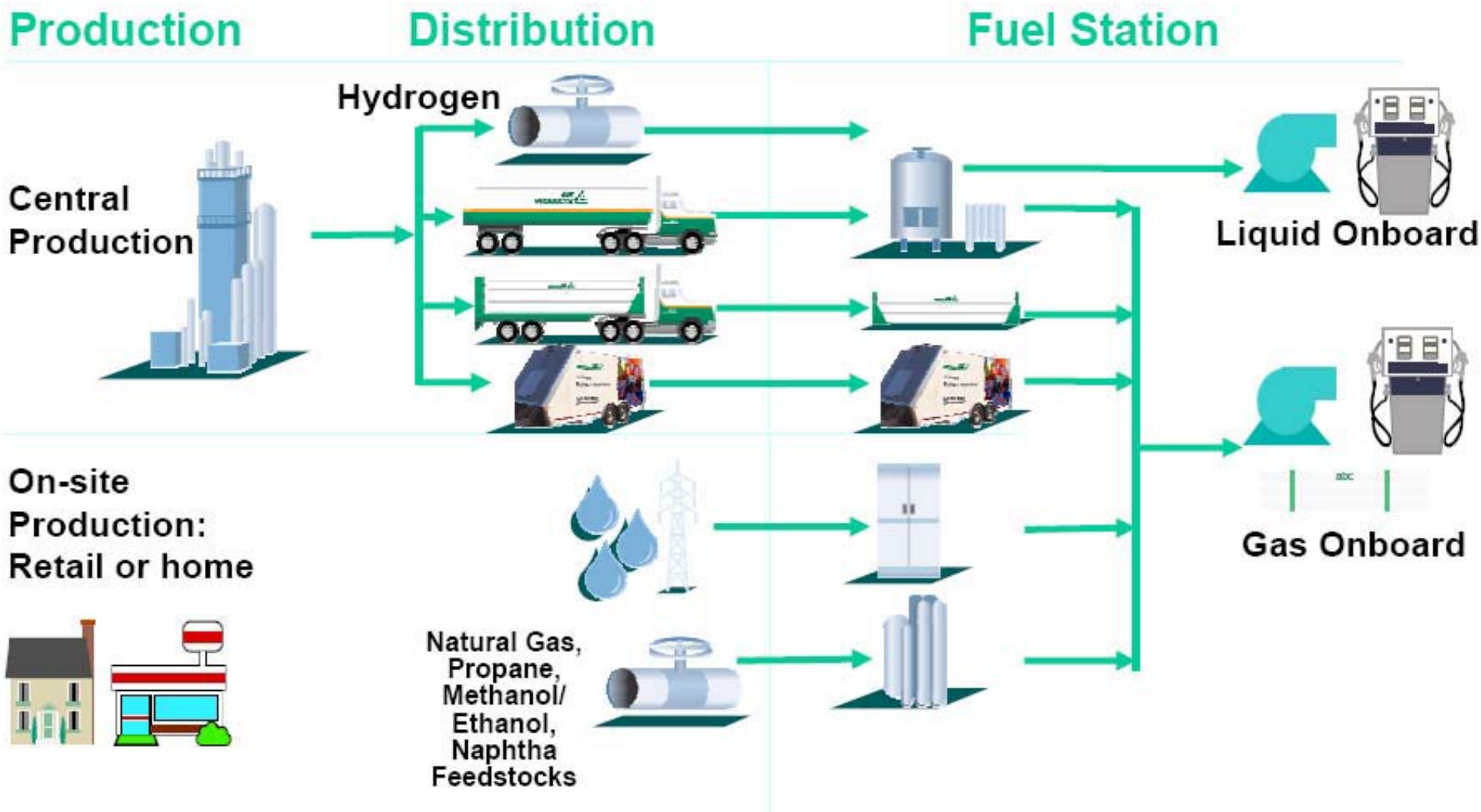
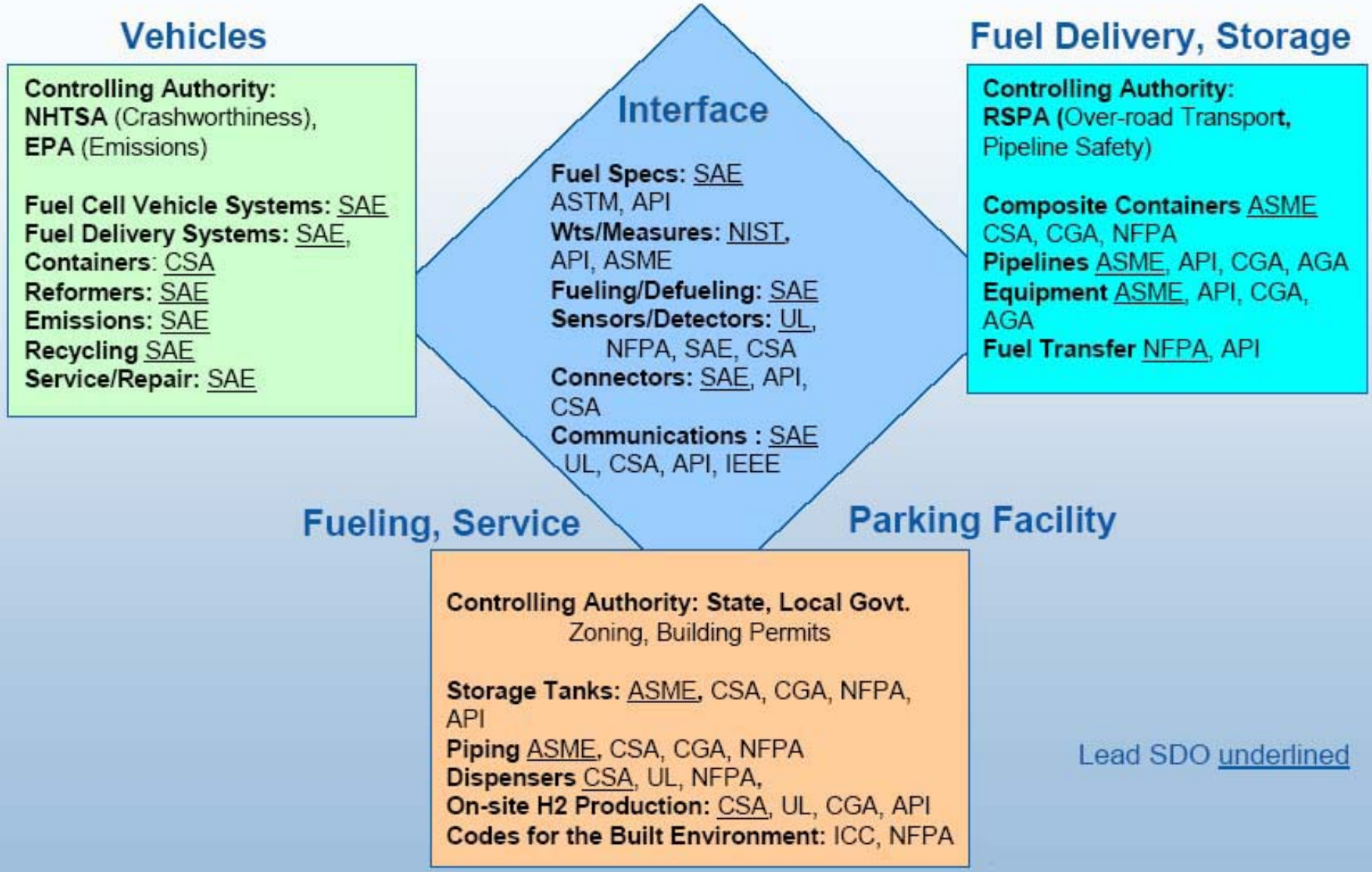
Approach to Standardization - Infrastructure



Approach to Standardization - Infrastructure



ASME Codes & Standards

ASME's Codes and Standards organization publishes standards and accredits users of standards

- First standard issued in 1884
- Approx. 600 consensus standards
- Over 100 ASME standards committees
- Over 3,600 volunteer committee members
- Address pressure technology, nuclear, safety, standardization, and performance test codes

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Participation in ASME C&S Activities

Why do volunteers participate?

- Volunteer experts find the experience rewarding
- Sponsoring companies also have benefits
  - Organization interests are considered
  - Initiate and influence direction and quality of standards, revisions and interpretations
  - Advanced knowledge of changes
  - Interface with experts in the field
  - Professional and personal development
  - Direct and indirect contributions to corporate bottom line

ASME Codes & Standards

- ASME Consensus Standards
  - Openness, balance of interest, due process, consensus
- American National Standards Institute (ANSI) accredited procedures
- Compliance with World Trade Organization (WTO) Technical Barriers to Trade (TBT) principles for international standards development
  - Transparency, openness, impartiality and consensus, effectiveness and relevance, coherence, and development dimension.

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ASME Codes & Standards

Standards development steps

- Initiate Standards Action
- Prerequisite technical work, R&D
- Draft standard – project team
- Distribute to cognizant groups for review and comment
- Standards Committee approval
- Public review
- Supervisory Board approval
- ANSI approval

International Standards

- ASME C&S International Presence
  - B&PV Code accepted in over 80 countries
  - 1,600 accredited manufacturers outside of U.S.
  - B31.3 Code is used almost exclusively world about for process piping
- ISO U.S. Technical Advisory Group (TAG) Participation
  - ASME administers 47 U.S. TAGs
  - Administers ISO/TC11 (B&PV) U.S. TAG
  - Member of ISO/TC 197 (Hydrogen) U.S. TAG

Existing ASME Codes and Standards Applicable to H_2 Infrastructure

- Tanks:
  - Boiler & Pressure Vessel Code (BPVC) Section VIII
    - Division 1 – Pressure Vessels
    - Division 2 – Alternative Rules
    - Division 3 – High Pressure Vessels
  - Code Case 2390
    - BPVC Section VIII, Div.3 - Composite Reinforced Pressure Vessels
  - BPVC Section X
    - Fiber-Reinforced Plastic Pressure Vessels
  - BPVC Section XII
    - Rules for Construction of Transport Tanks (1st edition July'04)

Existing ASME Codes and Standards Applicable to H_2 Infrastructure

- Piping and Pipelines:
  - B31.1 - Power piping
  - B31.3 - Process piping
  - B31.8 - Gas pipelines
  - B31.8S - Managing gas pipeline integrity
- Valves, Flanges, and Fittings:
  - B16.34 - Valves
  - B16.5 - Pipe flanges and fittings
  - Many others

Existing ASME Codes and Standards Applicable to H_2 Infrastructure

- Fuel Cells:
  - PTC 50 - Performance test code on fuel cell power systems
- Steam Generators:
  - PTC 4 - Fired steam generators
- Flow Measurement:
  - MFC-3M: Fluid flow in pipes using orifice nozzle and venturi
  - MFC-11M: Fluid flow by coriolis mass flowmeters

New Standards Actions

- Code for hydrogen piping and pipelines - B31 Hydrogen Section Committee formed to develop a new code.
- Portable, storage, and transport tanks in hydrogen service - BPVC project team formed to develop needed changes to existing codes or new standards.

Code for Hydrogen Piping and Pipelines

B31 Hydrogen Section Committee to develop a new code for H_2 piping and pipelines

- Include requirements specific to H_2 service for power, process, transportation, distribution, commercial, and residential applications
- Balance reference and incorporation of applicable sections of B31.1, B31.3 and B31.8
- Have separate parts for industrial, commercial/residential and pipelines
- Include new requirements for construction, operation, and maintenance

Portable, Storage and Transport Tanks in Hydrogen Service

B&PVC Project team to develop requirements for H_2 gas storage up to 100MPa (15,000 psi)

- Metallic Tanks
  - New requirements for BPVC Section VIII Division 1
  - New post-construction guidelines for inspection of cracking
  - New rules for periodic in-service inspection and testing
  - High strength steel and aluminum
- Composite Tanks
  - Develop new requirements for BPVC Section VIII Division 1
  - Include composite metal/FRP tanks, FRP, lined FRP tanks
- Nonmetallic Tanks
  - Develop a new performance-based standard for portable tanks.

Invitation to Participate

- Anticipate standards needs and make them known to SDOs
  - Industry's needs drive standards development
  - Urgency impacts development schedule
- Participate on ASME H_2 project teams and standards committees
  - Volunteer standards committee membership
  - Industry support on standards committees essential
  - Quality of support impacts technical relevance
  - Level of support impacts development schedule

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Invitation to Participate

- Visit ASME H_2 C&S Website:

  http://www.asme.org/cns/hydrogen

- Staff Contacts:
  - H_2 Piping and Pipelines

    Paul Stumpf, stumpfpa@asme.org, 212-591-8536
  - H_2 Tanks

    Gerry Eisenberg, Eisenbergg@asme.org, 212-591-8510

Next Meetings

- BPV H_2 Project Team
  - Boiler Code Week
  - Aug 30 - September 3, 2004, New Orleans, LA
- B31 H_2 Project Team
  - B31 Piping Code Week
  - September 20-24, 2004, San Francisco, CA

Thank You

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